

Fenimore Landfill

Long-term Remedy Fact Sheet

March 28, 2014



What material at the Fenimore landfill has produced hydrogen sulfide gas?

According to SEP's records, a total of 375,366 cubic yards of various fill material was brought to the Fenimore landfill between December 2011 and June 2013. Of that, about 54% was construction and demolition screenings (CDS; i.e., ground up wallboard) containing gypsum. That means that more than half of the material brought to the site by SEP has the potential to generate hydrogen sulfide (H₂S). Most of the CDS (about 60%) arrived at the site *before* Superstorm Sandy.

H₂S is produced by sulfur-reducing bacteria that process the sulfur in gypsum (calcium sulfate dihydrate). The naturally occurring bacteria depend on neutral pH (not basic or acidic), moisture, and anaerobic conditions (lack of oxygen). Temperature is also a factor. These conditions – neutral pH, moisture and lack of oxygen – already exist in the material in the Fenimore landfill, and through the sulfur-reducing bacteria this material has become the fuel for the production of H₂S.

DEP's long-term plan is designed to substantially reduce moisture in the landfill, and thereby essentially "turn off" the sulfur-reducing bacteria. This will virtually eliminate production of additional H₂S, while the gas collection and treatment system will eliminate the stored H₂S and any H₂S generated before the site dries out.

What is the outcome of the side-by-side comparison of excavation and capping?

The State of New Jersey Division of Law hired professional engineering firm Geosyntec to provide an analysis of abatement options to determine the best option. Geosyntec examined three possible options: targeted excavation of material, full excavation of material, and capping material in place.

Option 1 – Targeted excavation: SEP records kept during operations identified the date, volume and location of the CDS materials that were brought in and landfilled. These records show that CDS material was deposited throughout the approximately 19-acre active landfill. Therefore, targeted excavation is not possible while ensuring management of H₂S exposure to the community. Similar concern regarding this exposure is detailed below in the discussion of Option 2. It also should be noted that targeted removal of material would still require a gas collection and capping remedy.

Option 2 – Full excavation: Since more than half of the fill material is CDS that can generate H₂S, there is a significant quantity of H₂S stored within the "pore spaces" of the material deposited in the

landfill. This stored gas is substantial and at extremely high concentrations. Excavating the material would result in the uncontrolled release of that stored gas into the air and expose a large surrounding area to higher levels of H₂S than have been experienced previously even by those closest to the site. The uncontrolled release of H₂S would pose a risk to workers on the site and would cause significant odors and potentially unacceptable health exposures in the nearby neighborhoods. There is no way to control the H₂S and resulting odors that would be released from trucks traveling from the site. In addition, excavation would require double the time to implement and four times the amount of truck traffic. It is important to note that the CDS fill material originally brought to the site has been changed through biological processes. It is now wetter, heavier and thoroughly saturated with the sulfur-reducing bacteria that cause it to continuously produce H₂S.

Option 3 – Capping in place: This option provides the greatest public health protection and environmental control. Capping in place minimizes disturbance of material in the landfill and so minimizes the potential to release H₂S gas. The installation of a 19-acre cap with a geomembrane liner (a strong synthetic plastic) and a gas collection and treatment system provides an effective barrier to prevent moisture from getting into the landfill, which will reduce additional H₂S generation. A geomembrane liner and synthetic drainage layer cap is also preferred because it will significantly reduce the number of trucks required to bring materials to the site compared with the number of trucks that would be needed for a clay-based cap.

There are two other H₂S-producing landfills that have been excavated—one in New Jersey and one in Florida—so why can't Fenimore be excavated?

The Pepe Field site in Boonton, New Jersey, was not excavated to abate H₂S. While Pepe contained some H₂S, it was due to vegetable oil waste (not from CDS) and was at significantly lower concentrations than the H₂S concentrations at Fenimore. Pepe was excavated to address migration of methane gas and leachate into the surrounding neighborhoods. Migration of leachate and potentially explosive methane gas is not a factor at Fenimore.

Saufley Field Landfill in Pensacola, Florida implemented the same long-term remedy as is planned for Fenimore: capping the material in place, with an impermeable liner to cover the odor causing fill. A top layer of soil and material was excavated at Sauflay, but solely in order to prepare the site for capping. That material removed did not contain CDS at quantities that would cause uncontrolled release of H₂S. At Sauflay, the highest readings of H₂S at ground level were 140 ppm. At one gas extraction point at Fenimore in 2013, the concentration of H₂S gas was 250,000 ppm.

What is the current status of the odor control measures?

DEP placed Posi-Shell® over the area of SEP-placed material on the landfill to minimize water infiltration and improve odor control. Organic material has been applied to further control odors. Nine gas extraction wells were installed and are connected to an oxidizer with a custom scrubber to treat H₂S gas. The oxidizer is removing over 99% of the H₂S being collected, and the custom scrubber is removing over 99% of the sulfur oxide compounds that are generated when the H₂S gas is oxidized. The average daily H₂S levels at monitoring station ROX 4—historically the station with the highest

readings—are down significantly since the gas collection and treatment system began operations in October 2013 (<http://www.roxburynj.us/ArchiveCenter/ViewFile/Item/2170>).

What is the long-term closure plan?

DEP's long-term plan is designed to treat the H₂S gas that has already built up in the landfill and to change the conditions in the landfill that allow H₂S to be generated. The goal of the long-term plan is to substantially reduce the moisture in the landfill, and thereby essentially "turn off" the sulfur-reducing bacteria. This will in turn substantially reduce production of H₂S and the resulting odor problem.

There are three phases to the closure plan.

Phase 1 has begun. It includes the installation of a comprehensive gas collection system. A total of 21 new, larger and deeper gas extraction wells will be drilled and connected with an enhanced piping system. These are in addition to the nine existing gas extraction points. Flow from this system can be increased to 2,000 cubic feet per minute (cfm) from the existing maximum of 500 cfm. The interim treatment system will also be upgraded to treat the higher flow. This new, larger and comprehensive collection system is expected to control the gasses from the entire fill material area.

Once these additional wells are installed and connected to the oxidizer and scrubber, a much higher volume of H₂S gas will be pulled from the landfill and treated. This will greatly reduce the amount of H₂S gas, which will greatly reduce the possibility of odors in the short-term and throughout the summer. In addition, this improved system of wells will be connected to the long-term gas treatment technology once the cap is installed, which will further abate any odors while drying out the fill material.

Phase 2 is the installation of an impermeable liner and vegetative cap. Construction activities are being sequenced to minimize any odors that may result from the construction activity. Construction materials will be brought onto the site and stockpiled during the summer months. The impermeable liner will be installed across the entire site first so that control of the gas will be in place by the end of this year. The actual construction of the cap will take place in the fall when temperatures in and around the landfill are cooler. The cap consists of several layers. Clean soil is placed on the SEP material to act as a cushion for the placement of an impermeable liner. A synthetic drainage net is placed on the liner to allow any rain water to drain off of the liner. Eighteen inches of clean, imported soil will be placed on top of the drainage layer to allow for a vegetative final layer on top. This will most likely be a hardy grass mixture.

Phase 3 is the installation of a long-term gas treatment system to replace the interim oxidizer and scrubber. Once stored H₂S levels are reduced to low enough concentrations, the interim oxidizer and scrubber can be removed and replaced with a "dry" technology that requires less maintenance while ensuring the same protections to the community. The technologies being considered for the long-term treatment would remove the H₂S from the gas stream using either a biological process or a treated media (i.e., iron "sponge"). These technologies involve passing the gas through a filter that removes the H₂S. Data is being collected now to determine which system is best for Fenimore.

When will the odors stop?

By the end of this year when the liner is installed. Once the liner is installed over the SEP material, the gas system will collect all the H₂S. The treatment system will then treat the gas and eliminate the odor.

Are there other environmental benefits to capping?

Yes. By capping the material with an impermeable liner, groundwater will be protected by preventing rain water from getting into the landfill, thereby preventing leachate from forming. The stormwater controls that will be put in place as part of the cap construction will also protect surface water from runoff. When closure is complete with a vegetative cover, the area will resemble an open grass field. Other landfills with this type of cap have supported ecosystems of small mammals, reptiles, and raptors.

What is the expected schedule for closure?

Construction of the additional gas extraction wells and piping began in March. The contract for the cap is expected to be awarded in June and actual cap construction will start in September. Liner installation will be completed by the end of the year. Completion of the soil portion of the cap will be by June 2015. The design of the long-term treatment system should be completed by October 2014 and implemented shortly thereafter. Completion of the closure is expected by June 2015.

What is the detailed schedule for the installation of Phase 1?

Note that this preliminary construction schedule is subject to delays due to weather, availability of materials and achieving an aggressive installation rate.

Week of March 24

- Order Gas Pipe Materials
- Mobilize Equipment and Materials to Construct Well Drilling Pads
- Construct Well Drilling Pads

Week of March 31

- Mobilize Well Driller
- Driller Installs Gas Collection Wells
- Construct Well Drilling Pads

Week of April 7

- Driller Installs Gas Collection Wells

- Remove Well Drilling Pads
- Receive Gas Header Materials
- Pre-assemble Condensate Traps
- Set Up Temporary Well Depressurization in Area of Header Pipe Excavation
- Start North Header/Temporary Tie into Existing Western Header

Week of April 14

- Demobilize Well Driller
- Start Central Header

Week of April 21

- Finish Center Header/Tie into Treatment Pad
- Start Western Header (relocation of the existing header)

Week of April 28

- Finish Western Header and Tie into Treatment Pad
- Start Southern Header (relocation of the existing header)

Week of May 5

- Finish Southern Header
- Start Southern Toe Header & 6" Perforated Pipe

Week of May 12

- Finish Southern Toe Header & 6" Perforated Pipe
- Southern Liner

Week of May 19

- Start Western Toe Header & 6" Perforated Pipe

Week of May 26

- Western Toe Header & 6" Perforated Pipe
- Western Liner

What protective measures will be used when installing the additional 21 gas extraction wells so residents won't be exposed to high levels H₂S?

The new gas wells will be drilled one at a time. During installation of the new gas wells and piping, DEP will use the nine H₂S monitors that are located in the community to determine whether activity on the site is causing off-site H₂S levels to exceed the 30 ppb level established by the legacy landfill act. Should the levels of H₂S approach the 30 ppb level for two consecutive five-minute readings, DEP will immediately curtail onsite operations, assess the situation and then modify operations to prevent any off-site emissions of H₂S from reaching the 30 ppb level. Modifications could include slowing the drilling rate; installing industrial fans to redirect the H₂S gases; or modifying the existing collection system to allow for the collection of the gases.

Will there be additional trucks needed during closure construction?

There will be additional trucks needed to bring materials to the site. However, the work will occur over time so that the daily number of trucks can be reduced. It is estimated that 40-55 trucks per day will be needed from July – September 2014; 15-20 from September – November 2014; and 60-80 from March – April 2015. As always, DEP will work with local officials to ensure that safe traffic controls are in place utilizing the truck route.

How many years of maintenance will be required to maintain the capped landfill?

The cap will need to be maintained indefinitely, but it does not require extensive care. Maintenance includes twice-a-year mowing of the grass and periodic inspections of the cap to ensure that wildlife have not compromised the liner and that all environmental control measures are functioning correctly. Monitoring the gas treatment system and groundwater is also part of the site maintenance. The maintenance required of the gas treatment system will decrease over time as gas production inside the cap is reduced. It is expected to take about seven years for the production of H₂S to reach minimal levels, but the gas treatment system in place will abate any odors from the landfill.

Do other New Jersey landfills have this technology?

The capping being used at this site, an impermeable cap, is the technical standard for landfill caps when gasses need to be controlled and percolation of rainwater is of concern. Locally, DEP has installed these caps at the two Combe Fill landfills in Mount Olive and Chester Townships. Those caps used clay, but the use of a geomembrane instead of clay was selected at Fenimore to reduce truck traffic and reduce the time for installation.

What about the remainder of the landfill—will it be properly closed?

Because the original municipal landfill was never properly closed, there will need to be a determination made in the future as to how to handle the landfill.

What measures will be put in place so that Roxbury does not have a summer and fall like last year?

Last summer and fall, Fenimore landfill did not have the oxidizer and custom scrubber system that is now operating 24/7 to treat H₂S gas. This spring, additional gas collection wells will be installed to extract more gas, further reducing emissions from the landfill. By getting the new gas collection system installed this spring before the summer temperatures rise, DEP expects to be able to control essentially all of the H₂S being generated at the site.

What is DEP's authority regarding the landfill?

The Emergency Order issued by DEP Commissioner Martin on June 26, 2013 authorized DEP to take temporary control of the Fenimore Landfill because it posed an imminent threat to the environment. Under the Emergency Order, which was authorized pursuant to the Solid Waste Management Act, DEP inspectors, engineers and contractors accessed the site in order to abate the H₂S emissions. The Legacy Landfill Act, signed by Governor Christie on June 26, 2013, also gave DEP the authority to seek termination of administrative consent orders (ACOs) and closure plans issued to legacy landfills where the operators of those landfills were in material violation of an ACO or Closure Plan. On November 14, 2013, the Superior Court, Morris County, terminated the ACO and Closure Plan issued to the owners of the Fenimore Landfill, and ordered them to pay costs for H₂S abatement. A hearing regarding those costs has not yet been held.

Who will be responsible for the operation and maintenance of the scrubber as well as air monitoring? Who will pay for it?

DEP will perform maintenance and operation of all necessary equipment. The State will pay for it.

Will backup generators be installed on the system?

Yes, a back-up generator will be installed on site. The order was placed with the vendor. We will work with the contractor to get it as soon as possible.

Will DEP build a solar farm once the landfill is capped?

No.

Is the water being used at the landfill drying up my well?

Water used for operations at the Fenimore landfill is obtained from the public water supply and therefore has no impact on wells near the landfill.

What testing of private wells has been conducted to ensure that contamination is not migrating off-site?

On July 25-26, 2012, DEP sampled 25 private drinking water wells located primarily on Mountain Road. The samples were analyzed for volatile organic compounds (VOCs). VOCs were not detected in any of the wells sampled.

On July 31, 2013, Roxbury Township sampled five private wells in the vicinity of the landfill, three municipal wells and the Ledgewood Pond. The wells were analyzed for sulfides. There is no test for

H₂S in water. The Township reports that the results were not in excess of normal background levels for groundwater in the area.

What testing of surface water has been conducted to ensure that contamination is not migrating off-site?

DEP sampled surface waters, specifically Ledgewood Pond during both dry and wet weather events in January and June of 2013. The results showed only background levels so there's no indication that Ledgewood Pond is contaminated from the landfill. The long-term remedy will prevent rain water from coming in contact with the SEP material, therefore surface water will be protected from runoff.

What measures is DEP taking to ensure that my well will not become contaminated by SEP materials leaching from the Fenimore landfill?

The impermeable liner that is being installed as part of the long-term plan will keep rain water out of the SEP material. This will prevent the formation of leachate. The gas treatment system will dry out material in the landfill, further reducing the creation of leachate and protecting groundwater from being contaminated. In addition, DEP will be installing monitoring wells at the perimeter of the landfill for long-term observations.

How does the closure plan impact the two streams that run through the property?

The two streams that existed before any landfilling were altered by the original municipal landfill operations. Those streams now flow around the original landfill. Since the closure plan addresses only the 19-acre SEP area, those streams do not flow under the cap.

What additional air monitoring has the DEP conducted at the Fenimore landfill?

At the request of Roxbury Township, DEP conducted air monitoring for 68 volatile organic compounds (VOCs) along the perimeter of the landfill overnight in August 2013. The samples were collected using four ambient air sampling canisters, which were placed along the tree line of the Fenimore landfill in all four directions to collect an eight-hour sample at each location. Laboratory analysis indicated that 21 compounds detected either were at background levels, were below health-based indoor air screening levels used by DEP for acceptable exposure to indoor air, or are generally regarded as having low toxicity and do not even have screening levels. All of the compounds detected are chemicals that are typically found in air and are generated by household, commercial or industrial activity. A detailed summary of the testing can be found at <http://www.roxburynj.us/ArchiveCenter/ViewFile/Item/1308>.

What are the results from the stack testing done on the scrubber in order for it to become operational?

Stack testing was done to determine the efficiencies of the treatment system and to develop data to ensure emissions meet the National Ambient Air Quality Standards (NAAQS) of 75 ppb for SO₂. Initial data shows that >99% of H₂S was destroyed and >99% of SO₂ was removed.

Were mercaptans and sulfides included as part of the stack testing?

Individual mercaptan and sulfide compounds were not sampled and analyzed for during stack testing because the concentrations of these compounds are present in landfill gas at significantly lower concentrations than H₂S. Any trace amounts of other sulfur compounds emitted from the landfill would have been controlled to a similar high efficiency as H₂S by the oxidizer. Their products of combustion also would have been controlled to a similar high efficiency in the scrubber as SO₂.

Why was a permit for the scrubber not required?

For emergency actions, including abatement efforts at Fenimore landfill and other sites, DEP does a permit equivalent review to ensure that best available air pollution control technology is being used and that National Ambient Air Quality Standards (NAAQS) will not be exceeded. The NAAQS of relevance for the Fenimore landfill is the one-hour health standard for SO₂. The review of plans to use a thermal oxidizer at Fenimore determined that a scrubber would be needed to control SO₂ emissions resulting from the combustion of the H₂S gases. Stack testing was done to confirm that the scrubber captures and neutralizes at least 99% of the SO₂. Stack testing also indicated that emissions from the scrubber are well within EPA's NAAQS of 75 ppb one-hour average for SO₂. Three ambient SO₂ monitors were sited and are continuously operated.

What testing was conducted for methane?

DEP conducted subsurface soil gas surveys on June 24, 2013 to determine whether landfill gases were migrating to any degree toward residential dwellings. Other than the existing gas monitoring wells on the landfill, there were no significant concentrations of H₂S or methane migrating offsite. Methane concentrations at the perimeter of the site were well below NJDEP's regulatory action level of 12,000 ppm. Also, H₂S was not detected in any soil gas readings.

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